

Subject: Mission Services Customer Forum #8 Summary
Date: March 18, 2004
Location: Building 3 Goett Auditorium, Goddard Space Flight Center (GSFC)
Convened: 1:30pm **Adjourned:** 4:30pm

I. Attendance

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II. Welcome and Introductory Comments

Mr. Al Levine/Code 451, Customer Commitment Office Service Planning Manager, convened the forum by welcoming everyone to the 8th Mission Services Customer Forum (MSCF). Mr. Levine noted the full agenda and attributed it to the changes that have occurred since the last forum as well as upcoming changes planned for the program. Mr. Levine encouraged the attendees to share their thoughts and to actively participate in the forum.

Mr. Levine asked that participants complete the survey form, provided in the package, with their comments, opinions, and suggested topics for future forums. The surveys will serve to assess the effectiveness of the forums, identify areas for improvement, and provide feedback to center management.

Note

Presentations referenced in the following paragraphs are available online at URL <http://scp.gsfc.nasa.gov/sccf/>.

III. Opening Remarks

Mr. Phil Liebrecht/Code 450, Associate Director, Program Manager for Mission Services provided opening remarks. Mr. Liebrecht greeted the audience and expressed the sentiment that the forum would serve as a give-and-take session by capturing the issues and concerns of the customer community while providing information and insight to the customer community regarding the activities and challenges that are occurring within the program.

Mr. Liebrecht presented an overview of the Goddard Space Flight Center organizational structure.

The newly named Space Communications Program (SCP), formerly Mission Services Program, is part of the Code 400 Flight Programs and Projects Directorate headed by Ms. Dolly Perkins. The

name change is the result of the program having evolved to the point where it's primary focus is space communications and space tracking functions and capabilities. The program is comprised of the following: the Customer Commitment Office, the Transformational Communications Architecture Office, the Program Integration Office, the Space Network (SN) Project, the Ground Network (GN) Project, the Tracking and Data Relay Satellite (TDRS) Continuation Project, and the Mars Laser Communication Demonstration Project.

Mr. Liebrecht discussed the following major changes that have occurred within the program:

- The TDRS H, I, and J satellites have been accepted by the government and pre-formulation studies have begun for the TDRS Continuation effort. Current analysis indicates the need to replenish the fleet by 2012/2013. Some of the evolutionary changes under study as part of this task include optical technologies.
- The Mars Laser Communications Demonstration Project, headed by Mr. Rick Fitzgerald, began as a concept study about a year ago has transitioned to the formulation phase. The project team includes JPL and MIT LL. The Mars Telecom Orbiter (MTO) spacecraft is scheduled for launch around 2009. It will function as the equivalent of a high level TDRS orbiting Mars providing communications services for experiments on Mars. The Lasercom Terminal, a new technology component on the MTO, is capable of out performing the microwave antenna system on the spacecraft possibly by as much as an order of magnitude or more. It is envisioned that future versions of the Lasercom Terminal device will provide high definition television downlink from Mars. Additional information is available in the latest publication of the NASA Strategic Plan, Page 3.
- The Satellite Laser Ranging systems recently moved to the GN project. These systems support geo-dynamic activities and provide precise calibrations of radar altimeters on spacecrafts.
- Support to the Space Communications Architecture studies including the NASA Space Architect that is sponsored by NASA/HQ Code M3 and the Transformational Communications Architect effort that is a United States government wide effort.

Future needs for space communications support of the President's Space Exploration Initiative may include

- SN and GN services similar to what the existing networks provide along with an in-orbit vehicle rendezvous capability to support launch and early orbit as well as injection and reentry activities.
- Adapting to the early phase out of legacy systems including the Space Shuttle, Hubble Space Telescope (HST), and the International Space Station (ISS).
- High bandwidth lunar and Deep Space Communications services involving Ka-Band and/or optical capabilities that would enable Earth Science missions around other planets in addition to lunar robotic reconnaissance missions to the moon as early as 2007/2008. Lunar mission would be supported by some type of GN network capable of supporting 10's to 100's Mb/s data rates from the moon.
- Transitioning to an optical capability that would increase bandwidth capability although cost would be an issue. A space based optical service would be preferred, as it would provide higher availability.

Future needs for space communications support of Space and Earth science missions may include

- Continued desire for higher bandwidth for near-earth and Deep Space missions. Ka-Band and optical are two capabilities under consideration. A GN approach is likely for missions without a latency need while a SN approach is more likely for missions with a higher bandwidth and low latency need.
- Development of a transparency service, like a node on the internet. The science community has expressed a lot of interest in this type of technology. It would facilitate services such as on demand communications, Sensor WEBS, science alerts, 911. There are a number of formations and constellations under study.
- Continued desire for S-band tracking and high speed interfaces for launch, early orbit, and contingency support activities. An old concept involving Navigation Beacons is also under study.

Missions such as the Jupiter Icy Moon Orbiter and the James Webb Space Telescope will require new revolutionary capabilities. The Jupiter Icy Moon Orbiter, which is scheduled to launch in 2015 may utilize nuclear technologies, optical communication systems, and wide-band microwave communication systems. Initially, the James Webb Space Telescope will use a Ka-band communication system but ultimately it may require an optical communication system.

Mr. Liebrecht concluded that meeting future space communications needs would require an assortment of new, in some cases revolutionary, and mature technologies. Mr. Liebrecht noted that the program is excited about the future and looking forward to partnering with industry, JPL, academia, and others to meet future challenges.

IV. Open Floor

Mr. Levine opened the floor to the audience for comments, questions, and/or concerns. Mr. Levine provided a status on the TDRS Naming Convention. Based on recent discussions with WSC personnel, there is no interest in changing names at this time as things are working fine. The issue is considered closed.

Mr. Levine was asked how did the issue of the name change come up. Mr. Levine responded that several years ago in the process of changing the scheduling systems for the NCCDS and Service Planning System, a proposal was made to look at longitude however, it was never implemented because it was deemed desirable but not cost effective.

V. Mission Services Program (MSP) Code 450 Roadmap

Ms. Ronna Brockdorff/ITT provided an overview of the 450 Near Term Roadmap. Ms. Brockdorff noted that Mr. Frank Stocklin, the MSP Architect, has been working on a 5-year plan that will be expanded.

Ms. Brockdorff discussed the approach used in identifying new SN and GN capabilities. The CCSDS, the Space Frequency Group, the Integrated Mission Design Center, the various technology development programs, and a number of other entities provide inputs into the SN and GN Network Planning Management process where decisions are rendered on how to implement new capabilities and satisfy new objectives in a cost effective manner.

Ms. Brockdorff discussed the following concepts that are being proposed to meet future mission requirements:

- Wideband SN Service: This involves Ka-Band upgrades for supporting higher data rates with the Space Shuttle and the ISS. It also includes a High Rate Ku-Band service for Launch and Early Orbit Earth Science missions.
- Ka-Band Direct Downlinks Service for GN users: Solar Dynamics Observatory (SDO) is slated to be first user of this service.
- SN Multiple Access (MA) Services: There is a high demand for this service but it will require interference mitigation to limit EIRP interference between users.
- End-to-End IP Connectivity: Mr. Dave Israel is leading this task, which will allow inter-connectivity between missions like using a node on the internet.
- GN Support for Bandwidth Efficient Modulation/Coding Techniques: This will allow for increased utilization of the S-Band 5Mhz bandwidth and X-Band 10Mhz bandwidth services for GN users.
- SN Support for Bandwidth Efficient Modulation Techniques: This will allow for increased utilization of the Ku/Ka-Band 225Mhz bandwidth for SN users.
- Optical Communications for Near Earth and Deep Space: This entails a High Data Rate Optical service for Launch and Early Orbit missions and an Optical MA Signal service for Deep Space missions.

Ms. Brockdorff discussed several potential future technology initiatives and a timeline of when they would be available including the following:

- High Rate Data Compression (2004)
- 550 Mbps Data Rates (2004)
- Ka-Band Services at 550 Mbps (2005)
- Auto-configurable Ground Receiver (2009)

Ms. Brockdorff provided an updated status on the progress of SN and GN desired capabilities as follows:

- SN 1.2 Gbps Ka-Band Service (downscaled to 550 Mbps)
- TDRSS Augmentation Service for Satellites (under test)
- GN support for Bandwidth Efficient Modulations (no driving requirements)
- Functional 2-Way DAS SN Service (under study)
- SN MA Interference Mitigation (under study)
- Space Network Automated Scheduling (in progress)
- SN User End-to-End IP Connectivity (in progress)
- GN Ka-Band Gbps Data Service (no driving requirements)
- CCSDS SLE at SN/GN (under study)
- Optical Communications Relay for Deep Space/L1/L2 (under study)

Question from audience: Has there been any consideration given to the pursuit of a X-Band forward link capability? Ms. Brockdorff responded that she had no knowledge of any mission driving this requirement, but she would pose the question to Mr. Frank Stocklin.

Comment from audience: If this is the direction NASA is going, it looks like it would be overcome by the development of the optical capabilities that are being considered.

Question from audience: How would missions using multiple networks (i.e.; GN, DSN, USN) obtain services in a one stop-shopping mode? Mr. Jon Walker responded that the current NENS contract allows users to obtain multiple GN assets. For example, USN is a subcontractor to NENS. Code

450 can help arrange those assets or the customer can deal directly with the commercial enterprise. If customer deals directly, it is up to the customer to integrate the support.

Ms. Brockdorff indicated she would pose the question, "Is the commonality of a scheduling and data interface aspect something to be considered/addressed", to Mr. Frank Stocklin.

Mr. Walker noted that consolidating a schedule among multiple providers is something that would have to be looked into.

VI. Simulations Operations Center, Data Evaluation Lab and Compatibility Test Van

Mr. Y.Y. Bae/Code 586 presented an overview of the Simulations Operations Center (SOC), the Data Evaluation Lab (DEL) and the Compatibility Test Van (CTV). These facilities are located in Building 25 and the surrounding area.

The SOC provides test tools for Networks and Customer Interface Testing, support of ground system testing and training for all mission phases, development and operations of spacecraft simulations, portable test and simulations capabilities for remote sites as well Radio Frequency Simulations Operations Center (RFSOC) services. Projected SOC/RFSOC customers for the April – September 2004 timeframe are as follows:

- HST
- Shuttle Return-to-Flight
- Aura
- GOES-N
- Swift
- Automated Transfer Vehicle (ATV)
- Gamma Ray Large Area Telescope (GLAST)
- SDO

The DEL provides various recorded media of spacecraft data for GN and SN Tracking Stations; supports GN and SN data flows; analyzes, duplicates, and distributes data recorded on various media; provides bulk media degaussing services; provides International Satellite for Ionospheric Study (ISIS) mission data reduction, recording, and distribution to the National Science Foundation (NSF); maintains a secured vault in Building 16 for the safe storage of classified and unclassified data; and degausses and destroys computer hard drives for excess

The CTV conducts RF Compatibility Tests with GN and SN customer spacecrafts, supports SN Relay testing through TDRSS as well as special purpose Proof-of-Concept testing for GN and SN. Projected CTV customers for the April – September 2004 timeframe are as following:

- Gravity Probe-B
- Swift
- Low Cost Transceiver (LCT)
- Communications/Navigation Outage Forecasting System (C/NOFS)
- ATV
- GOES - O
- STARS (Range user and Rang safety)
- XSS-11
- H-IIA Transfer Vehicle (HTV)

- Demonstration of Automated Rendezvous Technology (DART)
- GLAST
- SDO

VII. Space Science Mission Operations

Ms. Leslie Ambrose/Code 451 Mission Commitment Manager presented a status of the Space Science Mission Operations Project.

VIII. Ground Network

IX. Space Network Status

Mr. Tom Gitlin/Code 452, SN Project Deputy Project Manager presented a status on SN activities.

Mr. Gitlin discussed the status of the TDRS Constellation. TDRS 8, 9, and 10 were successfully launched. TDRS 9 and 10 will be transitioned into operations at the 171W longitude slot for a minimum of six months each. TDRS-9 relocation activities are expected to begin around December 8, 2003.

Mr. Gitlin discussed the SN Ka-Band initiative, which is intended to prevent future Ku-Band frequency interference issues and allow higher return data rates that take advantage of the Ka-Band capabilities of the new TDRS satellites. This initiative is separated into the Ka-Band Data Services (KaDS) project and the Ka-Band Flight System (KaFS) project. Objectives for the KaDS project include reducing costs to missions by providing multi-mission ground station receivers capable of data rates of at least 1.2 Gbps and enabling standard spacecraft communications by standardizing signal design. The KaFS project will provide missions with a reduced risk, lower cost method to obtain flight communications systems for ultra-high data rate services. Development of flight systems engineering models is anticipated by 2007. The SN project is looking for opportunities to partner with potential customers on the KaFS endeavor. The System Requirements Reviews (SRRs) for both projects have been completed and the System Design Reviews (SDRs) for both projects are scheduled for early next year.

Mr. Gitlin discussed the Second Guam Antenna System (SGAS) status. After Guam was hit with the Super Typhoon on December 8, 2003, a decision was made to install a back-up antenna system at the site. Efforts to define requirements for the antenna system have recently begun. Since the facility is on US Navy property, the Navy will perform facility modifications. The NENS contractor will procure, install, integrate, and test the system. The SRR is scheduled for January 2004 with the Operational Readiness Review (ORR) scheduled for June 2005.

Mr. Gitlin discussed the status of the Demand Access System (DAS). DAS expands TDRS Multiple Access (MA) return service capabilities by adding new receivers, TCP/IP telemetry distribution capabilities, and limited CCSDS data processing capabilities via the NISN IONet. The DAS is controlled and monitored by the SN Web Services Interface (SWSI). SWSI/DAS is undergoing testing with a planned operational date of February 2004. The DAS Full Operations Capability Review was held on October 7, 2003. Work continues on resolutions to liens assigned at the review and a problem that was discovered after the review. Transition of DAS to the O&M contractor is planned for December 2003.

Mr. Gitlin discussed the Bilateral Ranging Transponder System (BRTS) augmentation. The BRTS is critical in providing SN customers with extremely accurate tracking services. The system is over 20 years old and difficult to repair. The loss of BRTS would adversely impact the SN's ability to

meet customers tracking requirements. As a result, plans are being developed to augment the existing system with new transponders. There is no intent to introduce new technologies or operations concepts. The SRR is scheduled for January 2004 and the ORR is scheduled for September 2005.

Mr. Gitlin was asked about the RFPs for the KaDS and KaFS projects. Mr. Gitlin responded that the RFPs for both projects should be issued in May 2005.

X. Earth Science Mission Operations (ESMO)

Mr. Ed Macie/Code 428 ESMO Operations Director presented a status on ESMO activities. Ongoing activities include preparing for the Aura launch and operations with a launch date of NET March 19, 2004; continuing CSOC to MOMS transition activities, including scoping out new tasks or areas not supported post CSOC; and continuing Space Operations Institute efforts through Capitol College.

Items to be worked include reviewing system architecture for obsolescence, cost efficiency, and risks; developing and maintaining a team of stake holders and service providers (Codes 290, 428, 444, 450, and 590) to provide oversight on the new contract; and developing an anomaly/incident reporting process.

Mr. Macie expressed concerns about the UPS going away, noting the dependency of EMSO projects that use the UPS without incident.

XI. Space Science Mission Operations (SSMO)

Mr. Ron Mahmot/Code 444, MOMS COTR and SSMO Project Manager presented an overview of the Codes 400 and 444 organizations and a status on SSMO activities.

The SNOE spacecraft is expected to re-enter around mid-December 2003. The SSMO project will request additional test time from the GN project during the re-entry period.

Under future missions and strategic planning, Memorandums of Agreements (MOAs) have been signed with Explorers, Solar Terrestrial Probes and Living With a Star Programs. Several other MOAs are pending completion. The project is also working with the GSFC Mission Services Evolution Center (GMSEC) to ensure that technology development and infusion efforts are integrated with mission needs. SMEX is actively working to implement GSMEC architecture.

Under Space Link Extension (SLE) activities, the project has agreed to eliminate the use of 4800-bit block communications with DSN. SOHO is pursuing a SLE demonstration with DSN in spring to early summer of 2004. WIRE was used as an on-orbit asset to evaluate the Avtec system at Wallops. Commanding from Houston was successful and follow-on activity is being defined.

Areas for more work include continuing to work CSOC to MOMS transition issues, coordinating the SNOE re-entry activities with supporting elements, and supporting an anomaly review audit of USN requested by GALEX. Code 450 has been requested to support this effort.

Mr. Mahmot was asked if information was available on the various missions he had discussed. Information can be obtained from the following websites:

- <http://www.gsfc.nasa.gov/space.html>
- <http://www.gsfc.nasa.gov/mission.html>

XII. Human Spaceflight

Mr. Bruce Schneck/HTSI CSR provided an overview on Human Spaceflight activities.

Mr. Schneck discussed the return to flight re-validation plans for the Integrated Network Elements. Following the STS-107 mishap, a team was assembled to re-validate the Integrated Networks. The team has developed a plan that encompasses verification and validation of new program requirements, significant network changes and anomalies, as well as any safety and security concerns. The plan was presented to and favorably received by key organizations at GSFC, JSC, and KSC. An Integrated Network ORR will be conducted approximately thirty days prior to launch, which is currently scheduled for September 2004. In addition, participation in the Mission Operations Directorate (MOD) and Level I/II Flight Readiness Reviews (FRR) will provide the Integrated Network readiness status to the Space Shuttle Program (SSP). A test plan has also been developed to provide directions for testing of the re-validation activities that include two new requirements. One of the new requirements is for External Tank Television and the other is for 6-Mbps downlink. Several return to flight activities have been completed. They include the Emergency Mission Control Center (EMCC) Full-up Simulation and FDF Proficiency Simulations. All tests were successfully conducted.

Mr. Schneck discussed the status of the International Space Station (ISS) 150-Mbps On-Orbit Testing. The ISS Ku-Band High Data Rate (HDR 50-75-150) was tested from 1995 to 1998. Until recently, only the 50-Mbps capability had been successfully tested and used on-orbit to transport ISS science data. In August 2003, a successful test was conducted of the higher data rates on-orbit. It is anticipated that the 150-Mbps capability will be available by the time the ground system is completed in 2004.

Mr. Schneck discussed the ISS Downlink Enhancement Architecture (IDEA). IDEA is a ground systems infrastructure that will allow the ISS program the ability to enhance its science return from 50 Mbps to 150 Mbps over the Ku-band downlink, which will result in reduced costs. The system will be implemented in two phases. The completion date for Phase I activities is December 31, 2003. The completion date for Phase II activities is December 2004.

Mr. Schneck discussed the ESA Automated Transfer Vehicle (ATV) and NASDA H-II Transfer Vehicle (HTV) activities. The ATV and HTV are logistics modules that will be used to re-supply the ISS. The final series of compatibility testing for ATV is scheduled for April 2004 with a planned launch date of April 2005. Initial compatibility testing for HTV is planned for June 2004, follow-on is testing planned for September 2005, and launch is planned for December 2007.

Mr. Schneck was asked if JPL will be providing Shuttle support in the future. Mr. Schneck responded that the Air Force had supported the Shuttle program for many years, but a few years ago they asked for millions of dollars. Mr. Gary Morse/JSC DA7 added that a several years ago the Air Force requested \$6,000,000 for their support, and NASA declined their request. Recently, the Air Force offered to support for \$110,000 non-recurring and \$40,000 per mission. NASA will accept this offer.

Mr. Schneck was asked about the possibility of going from a 1024 bit rate to a 2048 bit rate for forward link support. Mr. Schneck responded that both rates are possible but the constraint is the ground system inability to handle the 2048 bit rate.

Mr. Schneck was asked about a point of contact for the terrestrial link/150-Mbps effort. Mr. Morse recommended contacting Mr. Darrell Bailey/MSFC IDEA Project Manager for assistance.

A question was asked about the status of the effort to interface TDRS with the Transformation Communications Architecture (TCA). Mr. Walker responded that NASA continues to work with the TCA office and that NASA is still very much a part of the TCA endeavor.

XIII. Action Items

No formal action items were assigned at the meeting.

XIV. Closing

Mr. Levine closed the forum by thanking everyone for participating in the forum.

(original approved by:)

Al Levine

Code 451, Customer Commitment Office

Service Planning Manager